DOCUMENT RESUME

ED 137 062 SE 021 300

TITLE	Reviews of Data on Science Resources, No. 27. Education and Work Activities of Federal Scientific and Technical Personnel, January 1974.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-76-308
PUB DATE	May 76
NOTE	23p.; Not available in hard copy due to marginal legibility of original
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 038-000-00381-3, $0.40; Minimum charge of $1.00 for each mail order)
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Educational Background; *Employment Statistics; *Engineers; *Federal Government; Higher Education; *Manpower Utilization; Newsletters; Occupational Surveys; *Scientists; Statistical Data
IDENTIFIERS	National Science Foundation

ABSTRACT

This report examines the educational characteristics of science and engineering personnel employed by the Federal Government, including professional and non-professional personnel in non-science and engineering occupations who have their highest college level degree in science or engineering as of January, 1974. Information is provided on the following topics: Degree Levels of Federal Scientists and Engineers, Field of Highest Degree, Degree Levels at Selected Agencies, Work Activities of Federal Scientists and Engineers, Educational Levels of Federal Research and Development Engineers, Educational Levels of Science and Engineering Support Personnel, and Scientists and Engineers in Non-Science and Engineering Occupations. Tables showing the distribution of scientists and engineers by occupational group and government agency, highest degree held and selected agency, and occupations of federal scientists and engineers with degrees, are presented. (BT)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

BEST COPY AVAILABLE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Reviews OF DATA ON SCIENCE RESOURCES

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. NSF 76-308 No. 27, May 1976

ED 127 062

Education and Work Activities of Federal Scientific and Technical Personnel, January 1974

Introduction

The Federal Government uses scientific and technical expertise in many and diverse activities. Nearly 161,000 Federal civilian scientists and engineers[1]—about 10 percent of the U.S. total—work in virtually all science and engineering (S/E) fields. Their work activities include research, development, management, planning, natural resource operations, etc. Another 104,000 Federal personnel are S/E support personnel.

Finally, over 68,000 professional and nonprofessional personnel in non-S/E occupations have their highest college-level degree in science or engineering.[2] This report examines the educational characteristics of all these personnel and also the work activities of the scientists and engineers.

Several factors combined to make the data employed in this report older than those normally used. First, data were in a format requiring extensive manual calculations and restructuring for analytical purposes. Second, the educational data nonresponse was much greater than anticipated and required extensive investigation. Third, the results of the evaluation of the nonresponse led to changes in the thrust of the report. Fourth, analysis had been planned to incorporate October 1974 data. However, due to operational problems in production of 1974 data, delays were encountered which required this analysis to be based upon 1973 data. Fortunately, for purposes of this report, manpower composition in the Federal sector has probably not undergone recent major changes.

Summary

- Nearly 93 percent of all Federal scientists and engineers hold a 4-year or higher college-level degree, ranging from 84 percent at the Department of Transportation (DOT) to 99 percent at the Environmental Protection Agency (EPA).[3] Over 30 percent of these degreed personnel hold a doctorate, master's, or professional degree. Thus, Federal scientists and engineers are on the average more highly degreed than their counterparts in all sectors of the economy except in colleges and universities.[4]
- Nine out of 10 Federal scientists and engineers with 4-year or higher college-level degrees have these degrees in science or engineering.
- Three of every 10 Federal scientists and engineers are engaged in research and development, as are one of every two advanced-degree personnel.
- Two of every three Federal Ph.D. scientists and engineers are engaged in research and development, as are two of every five master's-degree personnel, and one of every two professional-degree personnel.
- The 10 States with the highest Federal civilian employment account for 59 percent of Federal scientists and engineers.

[1] The S/E series used in this report are listed in table A.

[2] Excluded from this report are the unknown number of Federal personnel in non-S/E occupations who may hold a 4-year college degree in science or engineering but whose highest degree is in a non-S/E field.

[3] The distributions of Federal scientists and engineers by degree level in this report are based on the 84 percent of Federal scientists and 79 percent of Federal engineers who reported their highest level of educational attainment. (See technical notes.)

[4] Sectoral data are from the 1974 National Survey of Scientists and Engineers, hereafter referred to as the National Sample. (See technical notes.)

(Prepared in the Manpower Utilization Studies Group, Division of Science Resources Studies)

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price 40 cents
Stock No. 038-000-00381-2
There is a minimum charge of $1.00 for each mail order

SE 021 300

Degree Levels of Federal Scientists and Engineers

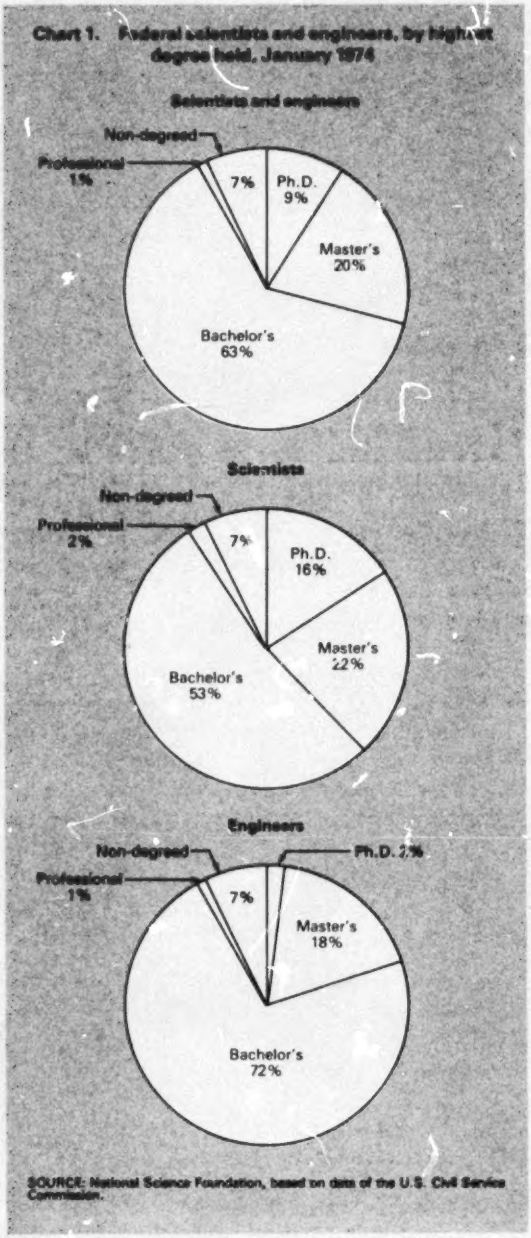
Among the 161,000 Federal civilian scientists and engineers in January 1974 (table A) were 131,600 personnel whose highest degree level was known.[5] The 65,200 scientists for whom information was available included 60,800 personnel (93 percent) with a 4-year or higher college degree, and 4,400 lacking such degrees. The 66,400 engineers included 61,500 personnel (93 percent) with a 4-year or higher college degree, and 4,900 lacking such degrees. Among both scientists and engineers, by highest degree, the bachelor's degree dominated (chart 1 and table B).

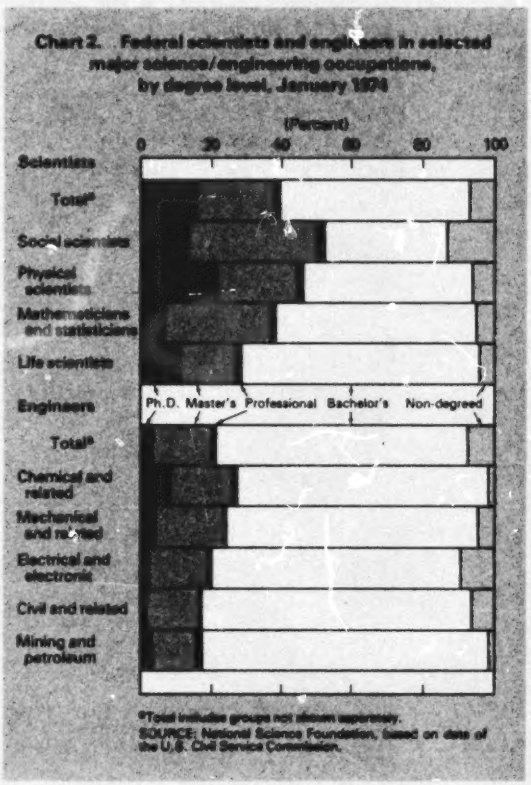
Comparing Federal scientists with Federal engineers shows that about twice as many Federal scientists held graduate degrees (38 percent to 20 percent) with the largest difference occurring in Ph.D.'s (16 percent versus 2 percent, respectively). A sectoral comparison of scientists and engineers combined shows 38 percent of Federal scientists and engineers with advanced degrees; about equal to the 40 percent of non-Federal scientists and engineers so degreed. Excluding personnel in academia, where 93 percent of the scientists and engineers have advanced degrees, the proportion of non-Federal scientists and engineers drops to 33 percent—below the Federal percentage.

Well over 90 percent of the major S/E groups—except social scientists—held 4-year college degrees. Of the social scientists, 87 percent held such degrees (chart 2). Stated another way, social scientists had double the percentage of nondegreed holders than any of the other sciences (13 percent versus 4 to 6 percent).

[5] Basic characteristics data, including education, were obtained from the Central Personnel Data File, U.S. Civil Service Commission.

The discrepancy between the total of 161,000 Federal civilian scientists and engineers in January 1974, and the 131,600 whose highest degree level was known, reflects nonresponse among Federal scientists and engineers to a special survey by the U.S. Civil Service Commission seeking educational characteristics data of all Federal white-collar workers.





Field of Highest Degree

About 92 percent of Federal scientists and engineers received their highest degree in science or engineering (chart 3). The following data show the proportions of Federal scientists and engineers at each degree level who received their highest degree in either science or engineering.

Highest degree level	Degree in science or engineering: Percent of scientists and engineers	Percent of scientists	Percent of engineers
All degree levels	92	92	92
Ph.D.	96	96	95
Master's	87	88	86
Professional	72	72	71
Bachelor's	94	94	94

The data on degree levels of Federal scientists and engineers also reveal the extent to which personnel trained in one S/E field work in another. For example, only 75 percent of degreed Federal scientists and 51 percent of degreed Federal engineers work in the same major field of science or engineering in which they hold their highest degree. Of the remaining scientists, 10 percent were employed in a field of science other than their degree field, 7 percent held degrees in engineering, and 8 percent held degrees in non-S/E fields. Of the remaining engineers, 33 percent worked in a field of engineering other than their degree field, 8 percent in scientific fields, and 8 percent in non-S/E fields. The much higher educational-occupational crossover among those employed as engineers appears to occur because engineers tend to have a common core of engineering education applicable to many areas of engineering endeavor (table 1 and table C).

TABLE 1.—PERCENT DISTRIBUTION OF FEDERAL SCIENTISTS AND ENGINEERS,[1] BY EDUCATIONAL[2] OCCUPATIONAL DIVISION AND DEGREE LEVEL: JANUARY 1974

Educational/occupational division	Ph.D.	Master's	Professional	Bachelor's
Total scientists	100	100	100	100
Degree field and occupational group the same	81	68	50	76
Degreed in one science field-employed in another	11	12	19	10
Degreed in engineering	4	8	3	7
Non-S/E degree	4	12	28	6
Total engineers	100	100	100	100
Degree field and occupational group the same	50	45	37	53
Degreed in one engineering field-employed in another	30	31	28	34
Degreed in science	14	10	6	8
Non-S/E degree	5	14	29	6

[1] Excludes personnel with less than a 4-year degree.
[2] Major field of highest degree.
Note: Detail may not add to 100 percent because of rounding.
Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

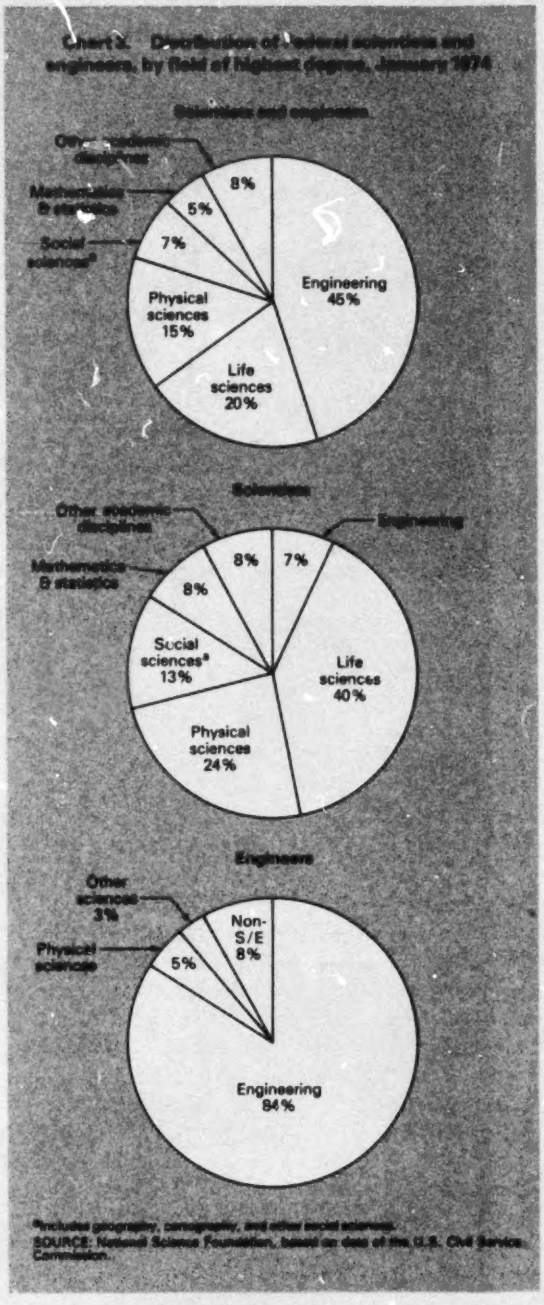


Chart C. Distribution of Federal scientists and engineers, by field of highest degree, January 1974

[a] Includes geography, oceanography, and other social sciences.
SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

Educational-occupational crossover among degreed Federal scientists and engineers varies considerably by major occupational group. Among scientists for example, 90 percent of life scientists held their highest degree in life sciences, versus a 52-percent field of study-occupation match for mathematicians and statisticians. Similarly, 75 percent of the electrical and electronic engineers have their highest degree in this academic discipline, but only 50 percent of mechanical and related engineers have their highest degree directly related to their work endeavor (table D).

Degree Levels at Selected Agencies

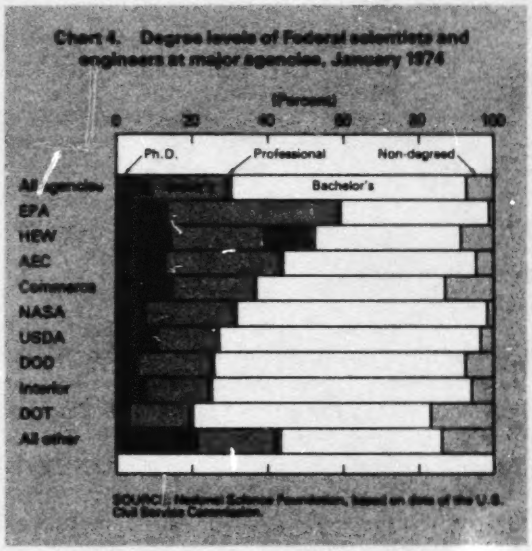
The proportion of Federal scientists and engineers with a 4-year or higher college-level degree varies by agency, from 84 percent of all scientists and engineers at DOT to 99 percent at EPA. (See technical notes for response rates by agency.)

Agency	*Percent of scientists and engineers with college-level degree*
All agencies	93
Environmental Protection Agency	99
National Aeronautics and Space Administration	98
Department of Agriculture	96
Atomic Energy Commission	96
Department of the Interior	95
Department of Defense	92
Department of Health, Education, and Welfare	91
Department of Commerce	88
Department of Transportation	84
All other agencies	87

The percentages of scientists and of engineers at each agency lacking 4-year college-level degrees tended to be about the same except at DOT, where 18 percent of the engineers, but only 5 percent of the scientists, lacked such degrees.

Another measure of the utilization of S/E expertise among Federal agencies is the proportion of total Federal scientists and engineers with degrees above the bachelor's level. Thus, nearly 60 percent of EPA scientists and engineers held graduate degrees, followed by the Department of Health, Education, and Welfare (HEW)—53 percent, and the Atomic Energy Commission (now the Energy Research and Development Administration)—44 percent.

The combined percentage of scientists and engineers with advanced degrees at other agencies ranged from 21 percent at DOT to 37 percent at the Department of Commerce. In large measure, these lesser percentages reflect relatively greater employment of engineers, fewer of whom hold advanced degrees than do scientists (chart 4).



Importance of Advanced Degrees to Federal Science and Engineering

The rate of utilization of Federal scientists and engineers varies by degree level among the major S/E fields. For example, table 2 shows that life scientists account for nearly 50 percent, and physical scientists for 30 percent, of all scientists with bachelor's degrees. Conversely, at the Ph.D. level, physical scientists represent 45 percent, and life scientists 27 percent, of all scientists. Thus, a comparison of the Ph.D. distribution with the bachelor's distribution suggests it is more important for physical scientists to hold a Ph.D. than it is for life scientists. More generally, the data on scientists show that advanced degrees are most numerous among physical scientists, and physical science increases in importance as the degree level rises.

Work Activities of Federal Scientists and Engineers

The distribution of Federal scientists and engineers by function has remained largely unchanged since 1967, the first year such data were available. Nearly 30 percent perform research and development—the same proportion as in the non-Federal sector. Another 9

TABLE 2.—PERCENT DISTRIBUTION OF FEDERAL SCIENTISTS AND ENGINEERS, BY MAJOR OCCUPATIONAL GROUP OR SERIES AND HIGHEST DEGREE: JANUARY 1974

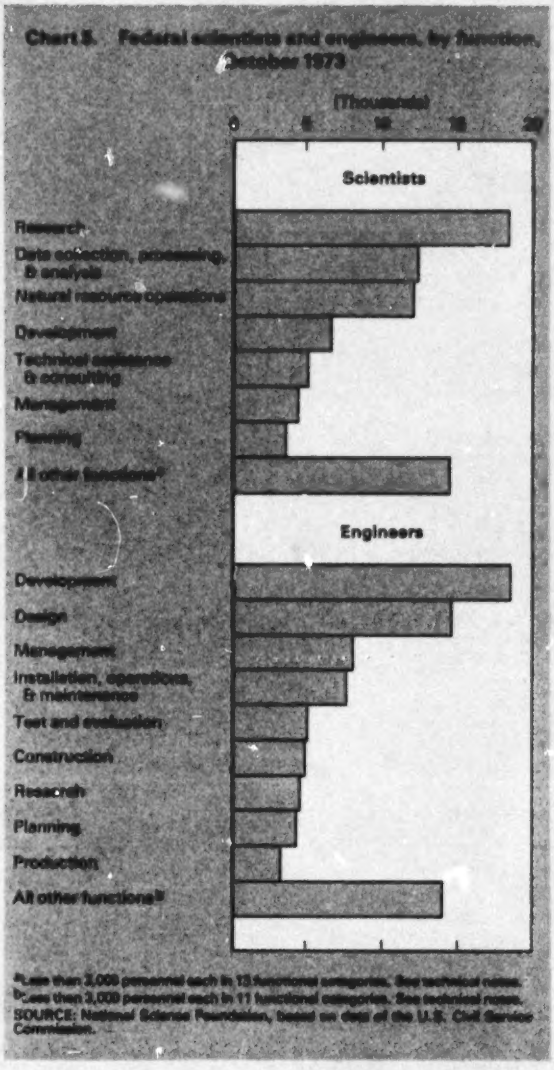
Major occupational group or series	Bachelor's	Professional	Master's	Ph.D
All scientific occupations	100.0	100.0	100.0	100.0
Physical sciences	30.3	38.1	35.8	45.3
Mathematics and statistics	12.7	8.0	16.8	4.9
Life sciences	49.3	38.4	28.3	27.3
Social sciences	5.8	11.3	14.9	7.9
Geography and cartography	1.4	.4	.4	.2
Psychology	.5	3.7	3.6	14.4
All engineering occupations	100.0	100.0	100.0	100.0
General engineering	17.9	27.0	16.9	11.9
Industrial engineering	2.6	4.2	2.2	.4
Materials engineering	.9	.8	1.5	4.0
Chemical and related engineering	1.4	2.8	1.8	4.9
Civil and related engineering	20.8	16.5	17.1	10.4
Electrical and electronic engineering	25.9	20.1	26.3	21.4
Mechanical and related engineering	26.7	22.9	30.8	41.4
Mining and petroleum engineering	1.2	2.6	.8	1.0
Other engineering	2.6	8.1	2.5	4.5

Note: Percents may not add to 100.0 because of rounding.
Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

percent each engage in design work and data collection-processing-analysis; 8 percent each are in natural resource operations and management; and in each of the following three categories, 5 percent do installation-operations-maintenance work, planning, and testing and evaluation. The remaining 22 percent are in other functional activities.

The respective distributions of Federal scientists and engineers by work activity show their diverse roles in Federal science and technology. Well over one-half of the Federal scientists are in one of the three categories of research (24 percent), natural resource operations (16 percent), or data collection-processing-analysis (16 percent). Similarly, 50 percent of the engineers are in development (22 percent), design (18 percent), or management (10 percent) (chart 5).

Scientists in each major group or series typically perform one function more than any other. For example, 4 of every 10 biologists engage primarily in natural resource operations. Similarly, research accounts for the largest number of physical scientists and psychologists, and data collection-processing-analysis for the most mathematicians and statisticians, and social scientists (table 3).



Development involves the largest proportion of electrical and electronic, mechanical, and chemical engineers. The major work activity of civil engineers is design, and for general engineers, management. Although more industrial engineers performed installation-operations-maintenance work (18 percent) than any other function, the great bulk are engaged in other functions.

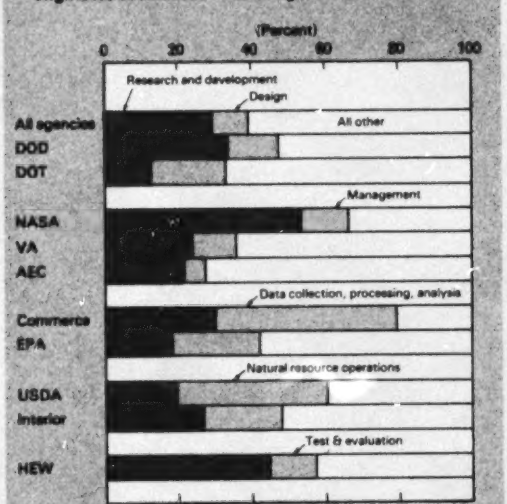
The utilization of Federal scientists and engineers in research and development varies considerably by agency. These two functions together account for from over one of every five USDA scientists and engineers to cover one in two at NASA; at DOT only one in every eight scientists and engineers performs research and development (chart 6).

TABLE 3. PERCENT DISTRIBUTION OF FEDERAL SCIENTISTS AND ENGINEERS, BY BROAD OCCUPATIONAL GROUP AND SELECTED FUNCTION: OCTOBER 1973

Broad occupational group or series	All functions	Development	Research	Design	Data collection, processing & analysis	Natural resource operations	Management	Installation, operations & maintenance	Planning	Test and evaluation	Research contract & grant administration	All other functions
Total scientists and engineers	100.0	15.5	14.1	9.4	8.8	7.9	7.6	4.9	4.8	4.8	.5	21.6
Scientists:												
Physical scientists	100.0	12.3	38.9	.7	17.2	.6	8.0	.5	1.8	7.1	1.3	11.5
Mathematics and statistics	100.0	25.1	8.0	.4	43.3	0	3.7	.8	4.3	2.7	.5	11.2
Life sciences	100.0	.7	20.4	(1)	.8	44.2	3.6	.2	4.8	1.7	.5	23.0
Social sciences	100.0	1.3	14.2	.1	29.4	.4	4.5	.1	15.1	.2	1.1	33.6
Geography and cartography	100.0	3.7	1.1	.3	41.2	1.2	6.1	0	2.1	(1)	0	44.4
Psychology	100.0	7.5	28.4	.2	.5	0	7.2	.1	1.0	2.3	1.0	51.7
Community planning	100.0	2.2	0	4.4	.6	.3	3.2	0	52.8	.6	0	35.8
Engineers:												
General engineering	100.0	14.0	1.8	9.9	1.6	.2	24.1	11.4	5.4	5.9	.7	25.0
Industrial engineering	100.0	4.7	.8	4.5	1.2	0	12.0	18.1	7.9	1.4	0	49.4
Chemical and related engineering	100.0	27.4	20.6	3.8	3.8	.1	5.9	2.4	1.1	4.7	.7	29.7
Civil and related engineering	100.0	2.1	2.5	29.8	5.0	2.5	6.1	4.2	15.1	.9	.1	31.6
Electrical and electronic engineering	100.0	34.1	3.7	14.4	2.2	.1	6.4	13.0	1.6	8.1	.2	16.3
Mechanical and related engineering	100.0	32.7	8.5	18.0	.7	(1)	6.4	7.9	1.1	8.4	.3	16.1
Other engineering	100.0	9.3	13.3	22.1	1.3	7.0	5.9	1.8	2.6	2.7	.2	33.8

[1]Less than .05 percent.
NOTE: Individual items may not add to totals because of rounding.
SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

Chart 6. Major work activities of scientists and engineers at selected Federal agencies, October 1973



SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

Educational Levels of Federal R&D Scientists and Engineers

Federal R&D activities utilize relatively more advanced-degree personnel than Federal non-R&D activities. The three of every 10 Federal scientists and engineers in research and development includes two of every three Ph.D. scientists and engineers, two of every five at the master's level, and nearly one of every two at the professional-degree level. Conversely, only one of every four bachelor's degree scientists and engineers, and one of every four lacking degrees, perform research and development (chart 7).

Over 60 percent of the Federal R&D scientists with a 4-year or higher college degree held a Ph.D., master's, or professional degree as compared with only 33 percent of the R&D engineers. The concentration of advanced degrees in science ranged from 77 percent at USDA to 54 percent at DOD (table 4). At DOD, Interior, and NASA, from 30 percent to 32 percent of the R&D engineers held advanced degrees. These three agencies also accounted for 94 percent of the advanced degrees held by Federal R&D engineers.

TABLE 4.--PERCENTAGE OF FEDERAL R&D SCIENTISTS AND ENGINEERS WITH ADVANCED DEGREES, BY SELECTED AGENCY: JANUARY 1974

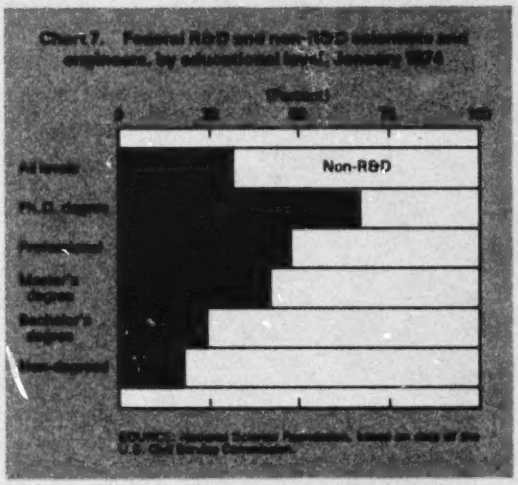
Agency	Percentage with advanced degrees	
	Scientists	Engineers
All agencies	[1]61.3	[2]32.6
Department of Defense	53.5	30.2
Department of Agriculture	77.2	59.2
Department of Health, Education, and Welfare	60.3	53.1
Department of Interior	56.0	32.2
National Aeronautics and Space Administration	59.7	31.9
Department of Commerce	60.5	44.8
Department of Transportation	64.9	50.5
Atomic Energy Commission	63.2	52.1
Environmental Protection Agency	66.5	67.7
All other agencies	64.3	36.5

[1] Of the R&D scientists, 3 percent held professional degrees.
[2] Of the R&D engineers, 1 percent held professional degrees.
Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

A comparison of the field distribution of degreed R&D scientists and engineers with non-R&D scientists and engineers shows relatively more R&D personnel with their highest degree in physical sciences and mathematics and statistics. On the other hand, research and development has relatively fewer personnel with their highest degree in engineering, life sciences, social sciences, and other academic disciplines.

Field of highest degree	*Non-R&D scientists and engineers*	*R&D scientists and engineers*
All degree fields	100%	100%
Physical sciences	10	25
Mathematics and statistics	4	6
Life sciences	23	15
Social sciences	6	3
Psychology	2	2
Engineering	47	44
Other academic disciplines	9	6

Note: Individual items may not add to 100 percent because of rounding.



Geographic Distribution

Geographically, Federal employment of scientists and engineers is relatively concentrated, with 59 percent employed in the top 10 States.[6] The contiguous District of Columbia-Maryland-Virginia area accounts for 29 percent of the U.S. total[7] (table 5).

R&D scientists and engineers are even more concentrated—73 percent are in the same 10 States. Likewise, 36 percent of total R&D personnel work in the District of Columbia-Maryland-Virginia area.

[6] This compares to 54 percent of all Federal white-collar workers employed in these same 10 States.
[7] In comparison, 24 percent of Federal white-collar employees are located in this area.

TABLE 5.—DISTRIBUTION OF FEDERAL SCIENTISTS AND ENGINEERS, BY SELECTED STATE: OCTOBER 1973

State	Total scientists and engineers		R&D scientists and engineers		Non-R&D scientists and engineers	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
All states	160,988	100.0	47,706	100.0	113,282	100.0
Maryland	18,947	11.8	8,241	17.3	10,706	9.4
District of Columbia	15,747	9.8	4,590	9.6	11,157	9.8
California	15,217	9.5	4,906	10.3	10,311	9.1
Virginia	11,262	7.0	4,307	9.0	6,955	6.1
Texas	6,898	4.3	1,463	3.1	5,435	4.8
Ohio	6,634	4.1	3,892	8.2	2,742	2.4
Pennsylvania	5,283	3.3	1,976	4.1	3,307	2.9
Alabama	5,276	3.3	2,560	5.4	2,716	2.4
New Jersey	4,616	2.9	1,779	3.7	2,837	2.5
Florida	4,402	2.7	1,263	2.6	3,139	2.8
All other states	66,706	41.4	12,729	26.7	53,977	47.7

Note: Percents may not add to 100.0 because of rounding.
Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

Educational Levels of S/E Support Personnel

The 104,600 Federal S/E support personnel in January 1974 included over 5,400 personnel with a 4-year or higher degree. For 90 percent of these personnel the bachelor's was the highest degree held. The distribution of highest degree by broad academic discipline was science, 54 percent; engineering, 11 percent; and other disciplines, 35 percent (table 6 and chart 8). In comparison, the distribution of the degreed-support personnel by broad occupational group was science, 57 percent; and engineering, 43 percent.

The percentage of support personnel in the physical science, life science, and mathematics and statistics occupational groups with at least a bachelor's degree was roughly the same as the proportions of total scientific support personnel in these groups. For social sciences (including psychology), and geography and cartography the proportions of support personnel with degrees varied noticeably from the percentages of total support personnel (table 7).

Engineering technicians were 38 percent of degreed engineering support personnel; equipment specialists, 17 percent; and engineering draftsmen, 4 percent. In these three categories, the percentage of degreed personnel was approximately the same as for all engineering support personnel. On the other hand, the 23 percent of degreed personnel who were electronics technicians and the 9 percent who were construction analysts compare with 35 percent and 2 percent, respectively, of total engineering support personnel in these categories.

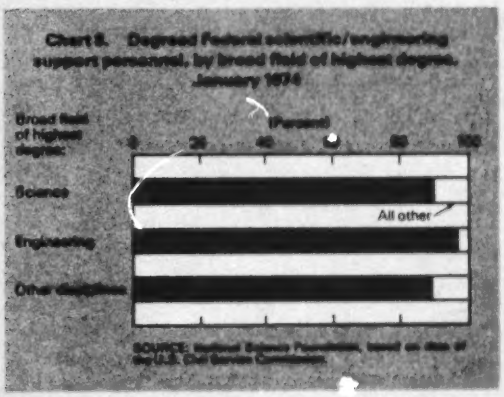


Chart 8. Degreed Federal scientific/engineering support personnel, by broad field of highest degree, January 1974

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

Scientists and Engineers in Non-S/E Occupations

About 68,200 federally employed personnel held a bachelor's or higher degree in science or engineering but were in occupations not classified as science or engineering. However, many of these personnel utilize their S/E training in their work. The largest numbers of such personnel in non-S/E occupations were in general administrative and office service work, 18 percent; investigatory occupations,[8] 11 percent; business and industry,[9] 9 percent; medical occupations,[10] 7

[8] Includes occupations such as consumer safety inspection, food inspection, criminal investigating, etc.

[9] Includes occupations such as transportation industry analyst, industrial specialist, insurance examining, contract and procurement, etc.

TABLE 6. ACADEMIC DISCIPLINES OF DEGREED FEDERAL SCIENCE/ENGINEERING SUPPORT PERSONNEL, BY OCCUPATIONAL GROUP: JANUARY 1974

Academic discipline	Total support personnel	Total scientific support personnel	Occupational group					
			Physical sciences	Mathematics and statistics	Life sciences	Social sciences and psychology	Geography and cartography	Engineering
All disciplines	5,443	3,085	573	292	1,593	272	356	2,358
Physical sciences	480	340	185	2	82	2	69	140
Mathematics and statistics	202	89	18	47	13	2	9	113
Life sciences	1,551	1,383	164	12	1,158	5	44	168
Social sciences and psychology	694	492	53	65	86	213	75	202
Engineering	627	66	23	1	16	–	26	561
Computer and systems disciplines	9	4	2	–	1	–	1	5
Other academic disciplines	1,880	711	128	165	237	50	131	1,169

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

TABLE 7.—DISTRIBUTION OF FEDERAL SCIENCE/ ENGINEERING-SUPPORT PERSONNEL, BY MAJOR GROUP OR SERIES

Major group or series	Total[1]		Degreed[2]	
	Number	Percent distribution	Number	Percent distribution
Total support personnel	104,636	—	5,443	—
Scientific personnel	36,393	100.0	3,085	100.0
Physical sciences	7,928	21.8	573	18.6
Mathematics and statistics	4,507	12.4	292	9.5
Life sciences	17,487	48.1	1,593	51.6
Social science and psychology	520	1.4	272	8.8
Geography and cartography	5,951	16.4	355	11.5
Engineering personnel	68,243	100.0	2,358	100.0
Engineering technician	25,512	37.4	885	37.5
Engineering drafting	2,470	3.6	98	4.2
Electronics technician	23,700	34.7	546	23.2
Construction analyst	1,113	1.6	205	8.7
Industrial engineering technician	2,671	3.9	195	8.3
Equipment specialist	10,604	15.5	402	17.0
Facility management	2,164	3.2	25	1.1
Fishery methods and equipment	9	(3)	2	.1

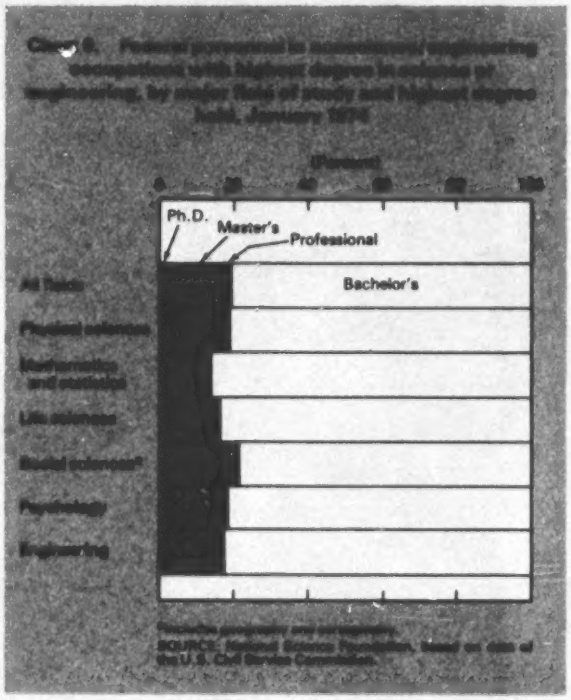
[1] As of October 1973.
[2] As of January 1974.
[3] Less than .05 percent.
Note: Percents may not add to 100.0 because of rounding.
Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

percent; and computer occupations,[11] 6 percent. Another 49 percent were in all other non-S/E occupations combined.

The largest group of S/E educated personnel working in non-S/E areas was the 22 percent at DOD. In comparison, 45 percent of all Federal scientists and engineers work at DOD. The next largest proportion of S/E degreed personnel employed in non-S/E occupations was the 20 percent at HEW—far above the 4 percent of all Federal scientists and engineers at that agency (table 8). The percentage distribution of personnel with degrees in science and engineering but employed in non-S/E occupations among selected agencies was as follows:

Department of Defense	22%
Department of Health, Education, and Welfare	20%
Department of Agriculture	6%
Department of Commerce	4%
Department of the Interior	3%
Department of Transportation	3%
National Aeronautics and Space Administration	1%
Atomic Energy Commission	1%
Environmental Protection Agency	1%
All other	39%

Fully 93 percent of the Federal personnel with their highest degree in science and engineering, but working in other occupations, were trained as scientists. Only 2 percent of the S/E-degreed personnel in non-S/E occupations held Ph.D.'s, and another 16 percent held master's degrees (versus 9 percent and 20 percent, respectively, for Federal scientists and engineers) (chart 9).



[10] Occupational series have been categorized as science and engineering based on the series the Division of Science Resources Studies has included in its annual reports on Federal scientists and engineers. Thus, personnel in medical-related occupations, such as physicians (M.D.'s), dentists (D.D.S.'s), veterinarians (D.V.M.'s), general health scientists, etc., are considered in health rather than in science occupations.

[11] Some programmers and systems personnel undoubtedly engage in S/E work activities. It has not been possible, however, to separately identify such personnel for this report.

208-519 O - 76 - 3

TABLE 8. FEDERAL WHITE-COLLAR PERSONNEL IN NON-S/E OCCUPATIONS WHOSE HIGHEST DEGREE WAS IN SCIENCE OR ENGINEERING, BY FIELD OF HIGHEST DEGREE AND AGENCY: JANUARY 1974

Field of highest degree	All agencies	DOD	USDA	Interior	NASA	DOT	Commerce	HEW	EPA	AEC	All other agencies
All fields	68,223	15,139	4,222	2,240	732	2,023	2,396	13,831	348	568	26,724
Physical sciences	3,581	994	102	93	52	131	428	610	26	91	1,054
Mathematics and statistics	4,340	1,736	154	85	43	194	156	726	17	32	1,197
Life sciences	10,569	1,531	2,397	766	50	240	166	2,218	71	33	3,097
Social sciences	39,506	7,938	1,355	946	418	896	816	8,318	172	261	18,396
Psychology	5,435	1,269	97	126	47	128	83	1,620	21	14	2,030
Engineering	4,792	1,671	117	224	122	444	747	339	41	137	950

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

Technical Notes

The population of the 161,000 scientists and engineers and the 104,600 technical personnel shown in this report refers to a full count of such personnel as of October 1973 and was compiled by the U.S. Civil Service Commission (CSC) as part of its responsibility for Federal personnel statistics. Educational characteristics data were obtained by the CSC through a direct survey of all Federal white-collar workers and are as of January 1974.

Analysis of the educational characteristics of the population has been restricted in this report to proportional distributions for the 131,600 Federal scientists and engineers for whom educational information was available (84 percent of the scientists and 79 percent of the engineers). Based on the CSC's study of the distribution of the educational characteristics of those reporting, there is no evidence to indicate that an analysis of the educational characteristics of the 161,000 Federal scientists and engineers would change to any significant extent if identical data were also available for the 12,000 scientists and 18,000 engineers from the nonreporting population.

The coverage rates are unknown for the 68,200 personnel with degrees in science and engineering but who work in other areas, or among the 5,400 S/E support personnel who held degrees in science and engineering, discussed in this report.

The response rates of Federal scientists and engineers to the educational characteristics survey of Federal white-collar workers, by occupational group and agency, are as follows:

Major occupational group or series	*Response rates[1] (percent)*
Scientists and engineers, total	81.5
Scientists, total	84.4
Physical sciences	84.0
Mathematics and statistics	82.8
Life sciences	90.7
Geography and cartography	45.7
Social sciences	79.8
Psychology	93.4
Engineers, total	78.3
General engineering	80.2
Industrial engineering	69.2
Materials engineering	82.0
Chemical and related engineering	61.7
Civil engineering	80.1
Electrical and electronic engineering	76.6
Mechanical and related engineering	80.8
Other engineering	81.6
Agency	
All agencies	81.5
Department of Defense	74.1
Department of Agriculture	98.1
Department of the Interior	82.2
National Aeronautics and Space Administration	98.5
Department of Transportation	87.3
Department of Commerce	96.6
Department of Health, Education, and Welfare	101.4
Environmental Protection Agency	45.7
Atomic Energy Commission	97.7
All other agencies	64.4

[1] The denominators for the response rates were the numbers of scientists and engineers in each major occupational group or series in the October 1973 white-collar survey data.

Source: National Science Foundation, based on data of the U.S. Civil Service Commission.

National Sample data are used in several places in this report to compare degree levels of Federal and non-Federal scientists and engineers. The sample of 50,000 represents 1.4 million individuals who had been identified as scientists and engineers from the 1970 Census of Population on the basis of a set of criteria developed by the National Science Foundation with the assistance of appropriate professional societies. While National Sample data are not fully comparable to CPDF data, they can be used for approximate percentage comparisons of the degree levels of Federal and non-Federal scientists and engineers. The National Sample data used in this report are based on the 1974 National Sample survey.

Functional Category Definitions[1]

Research. Systematic, critical, intensive investigation directed toward the development of new or fuller scientific knowledge of the subject studied. It may be with or without reference to a specific application. The work involves theoretical, taxonomic, and experimental investigations or simulation of experiments and conditions to:

(1) Determine the nature, magnitude, and interrelationships of natural and social phenomena and processes,

(2) Create or develop theoretical or experimental means of investigating such phenomena or processes, and

(3) Develop the principles, criteria, methods and a body of data of general applicability for use by others.

Excluded from this category is work concerned primarily with the administration and monitoring of research contracts and research grants.

Research Contract and Grant Administration. The administration and monitoring of research contracts and research grants.

Development. Systematic application of scientific knowledge directed toward the creation of new or substantially improved equipment, materials, instrumentation, devices, systems, mathematical models, processes, techniques, and procedures which will perform a useful function or be suitable for a particular duty.

The work involves such activities as:

(1) Establishing requirements for technical objectives and characteristics;

(2) Devising and evaluating concepts for design approaches: criteria, parameters, characteristics, and interrelationships;

(3) Experimenting, investigating, and testing to produce new data, mathematical models, or methods to test concepts, formulate design criteria, and measure and predict natural and social phenomena and performance;

(4) Designing and developing prototypes, breadboards, and engineering models including the direction of their fabrication as required;

(5) Developing standards and test plans to assure reliability; and

(6) Managing specific developments being executed inhouse or under contract.

[1] U.S. Civil Service Commission Federal Personnel Manual Letter #293-9, March 24, 1967.

Development, like research, advances the state of the art, but it is further characterized by the creation of specific end-items in the form of equipment or equipment systems ("hardware" development) and/or methodologies, mathematical models, procedures and techniques ("software" development).

Test and Evaluation. The testing of equipment, materials, devices, components, systems and methodologies under controlled conditions and the systematic evaluation of test data to determine the degree of compliance of the test item with predetermined criteria and requirements. This work is characterized by the development and application of test plans to be carried out inhouse or under contract or grant utilizing one or more of the following kinds of tests: physical measurement techniques; controlled laboratory, shop, and field (demonstration) trials; and simulated environmental techniques.

This category includes:

(1) Development testing to determine the suitability of the test item for use in its environment;

(2) Production and postproduction testing to determine operational readiness;

(3) Testing in regulatory programs to determine compliance with laws, regulations and standards, and

(4) Testing in the social sciences using demonstration or experimental and control groups to determine the effectiveness of new methodologies or practices.

Design. The planning, synthesis, and portrayal for purposes of fabrication or construction of structures, equipment, materials, facilities, devices, and processes which will perform a useful function or be suitable for a certain duty.

The work involves such activities as:

(1) Investigating, analyzing, and determining needs and design considerations;

(2) Planning, synthesizing and proportioning the structure of mechanisms so that the result is achieved with safety and economy;

(3) Preparing design criteria, detailed design specifications, cost estimates, and operating instructions; and

(4) Reviewing and evaluating design proposals and designs prepared by others including the management of architectural and engineering contracts.

For present purposes, design in a research and development organization is the application of the known state of the art in the form of standard guidelines and references to prepare the detailed working plans and data required for fabrication, assembly, and production.

Construction. The original erection, repair, and improvement of structures that provide shelter for people and activities, support transportation systems, and control natural resources. The work involves surveillance and control of construction operations carried out inhouse or under Federal grants, contracts, or loans through such activities as:

(1) Conducting site surveys;

(2) Reviewing and interpreting project plans and specifications;

(3) Making cost analyses and estimates;

(4) Laying out and scheduling operations;

(5) Investigating materials, methods, and construction problems;

(6) Negotiating with utilities, contractors, and agencies involved; and

(7) Inspecting work in progress and completed work and final acceptance of completed work.

Production. The fabrication and manufacture of structures, equipment, materials, machines and devices. The work involves surveillance and control of production operations carried out inhouse or under contract through such activities as:

(1) Planning, directing, controlling, inspecting, and evaluating production processes, equipment, and facilities;

(2) Refining designs to adapt them to production facilities and processes; and

(3) Devising, applying, and monitoring procedures to measure and assure quality.

Installation, Operations, and Maintenance. The installing, assembling, integrating, and assuring of the proper technical operation and functioning of systems, facilities, machinery, and equipment. The work involves such activities as:

(1) Analyzing operating and environmental conditions to provide design inputs and feedbacks and modifying designs as necessary to adapt them to actual environments;

(2) Developing and determining logistic requirements, documentation, technical plans, procedures, controls and instructions;

(3) Equipping, supplying, and commissioning facilities;

(4) Analyzing performance and cost data and developing actual performance and cost data requirements;

(5) Integrating equipment installation and operating schedules;

(6) Managing onsite an operating facility such as a power plant, test range, mission control center, irrigation station, data acquisition station, or flight control station; and

(7) Managing installations, operations, or maintenance contracts.

Data Collection, Processing, and Analysis. The collection, processing, and analysis of general purpose scientific data describing natural and social phenomena. General purpose scientific data include newly gathered statistics, observations, instrument readings, measurements, specimens and other facts obtained from such activities as statistical and field surveys, exploration, laboratory analyses, photogrammetry, and compilations of operating records for use by others. The work involves such activities as:

(1) Determining data needs and data processing requirements;

(2) Planning, directing, and evaluating collection activities performed inhouse or under contract;

(3) Designing overall processing plans and systems to handle, control, operate, manipulate, reduce, store, check, and retrieve data;

(4) Analyzing raw and processed data for validity and subject-matter interpretation;

(5) Providing analytic services such as chemical analyses;

(6) Forecasting and projecting data and conditions; and

(7) Summarizing and presenting data for general use.

Excluded from this category are collection and analysis of data only for research and development projects and internal operating or administrative purposes such as policy formulation or planning.

Scientific and Technical Information. The processing and dissemination of published and unpublished technical documents and information on work in progress and completed work to facilitate their use. The work involves developing and implementing information systems through such activities as:

(1) Providing for the selection, acquisition, compilation, exchange, and storage of scientific and technical information;

(2) Cataloging, abstracting, and indexing information for retrieval and dissemination;

(3) Providing reference, literature search and bibliographic services for information users;

(4) Interpreting, evaluating, and briefing on the significance and relevance of information;

(5) Disseminating information through briefings, technical publications, and other communications media; and

(6) Classifying and declassifying technical information where use must be controlled in the national interest.

Standards and Specifications. The preparation and determination of mandatory and/or voluntary standards including rules, regulations, and codes.

These standards are for purposes of:

(1) Government regulation, and

(2) The assuring of the acceptability, quality, and/or standardization of products, materials, and parts as required for design, production, purchasing, logistics, and documentation.

The work involves the development of performance criteria, test and inspection methods, and data for the application of the standards to technological products and services.

Regulatory Enforcement and Licensing. The application and enforcement of laws, rules, regulations, orders, and governmental agreements through inspection, investigation, surveillance, licensing, certification, and similar activities. The work includes such activities as:

(1) Licensing power plants and radio stations;

(2) Enforcing plant or animal disease eradication programs;

(3) Inspecting operations for compliance with requirements;

(4) Approving utility rates and services;

(5) Investigating aircraft accidents;

(6) Allocating radio frequencies; and

(7) Determining compliance with engineering aspects of Federal tax laws.

Natural Resource Operations. The development and utilization of federally owned and trust lands and natural resources for the purposes of bringing current use into balance with natural processes of renewal to assure sustained yields to meet present and future public needs. Natural resources include land, air, and water and their related products or uses, such as soil, minerals, timber, forage, wildlife, power, and recreation. The work involves implementing programs and projects to inventory, classify, utilize, improve, conserve, regulate, protect, sell, lease, exchange, or market natural resources. Resource operations as defined here are concerned with managing and conserving the land and resources in a specified geographic area.

Clinical Practice, Counseling, and Ancillary Medical Services. The provision of direct clinical and related services to patients and clients including examination, testing, diagnosis, treatment, therapy, casework, counseling, disability evaluation, and related patient care services.

Planning. The study and projection of present and future needs and the formulation of alternative policies and ways of meeting these needs for the utilization of: Land; natural, social, industrial, material and manpower resources; physical facilities; and social and economic services and programs. The work involves:

(1) Gathering, compiling, analyzing and evaluating data;

(2) Projecting needs and establishing goals;

(3) Developing single or alternative plans, policies, programs, and recommendations and measures of their economic, social and political costs, benefits and feasibility; and

(4) Reevaluating progress to assure that plan objectives are realized in putting the plans into effect.

This category includes physical, economic, and social planning for land population centers and mission, policy, and program planning.

Management. The direction and control of scientific and engineering programs in any one or combination of functions in a line or staff capacity with responsibilities that have a direct and substantial effect on the organizations and programs managed. The work involves decisions, actions, recommendations that establish the basic content and character of the programs directed in terms of program objectives and priorities, program initiation and content, funding, and allocation of organizational resources.

This category is not intended to cover those primarily engaged in the supervision or monitoring of work carried out through contracts and grants or in contracts and grants administration. Such positions are to be coded to the appropriate function.

Teaching and Training. The teaching of scientific and technical subjects; the education and training of scientific and technical personnel inhouse and through programs consisting of fellowships, traineeships, and training grants; and the development of curriculums and training materials and aids.

Technical Assistance and Consulting. The provision of scientific and technical expert assistance, consultation, and advice to other scientific personnel; foreign governments; government agencies at the Federal, State, or local level; private industry, organized groups; and individuals. The work involves advising upon and promoting application of the results of research and specialized program knowledges.

Other—Not Elsewhere Classifiable. This category is to be used for:

(1) Positions with highly specialized activities which are not covered in any of the categories.

(2) Positions of such generalized nature that a primary function cannot be identified; and

(3) Trainee positions for which functional assignments have not been made.

TABLE A.—SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIES AND AGENCY: OCTOBER 1973

Occupational group and series	All agencies	Department of Defense					VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC
		Total	Army	Navy	Air Force	Other										
Scientists and engineers, total	160,988	72,851	28,995	30,115	11,495	4,356	3,155	24,490	6,029	12,911	11,972	7,188	5,391	3,495	2,374	2,119
Scientific Personnel	76,711	20,629	7,473	7,299	2,857	3,200	2,572	21,443	5,352	8,814	2,322	6,423	541	1,884	383	695
Physical sciences	26,374	10,662	3,902	4,562	1,462	716	683	1,579	1,820	3,445	1,416	3,985	170	1,107	121	608
Astronomy and space sciences	580	85	0	78	17	0	0	0	0	0	474	3	0	0	0	0
Chemistry	7,968	2,376	1,107	776	369	124	634	1,147	1,810	594	82	344	30	587	80	104
General physical sciences	4,446	1,959	940	422	221	370	4	40	43	253	469	727	70	426	4	200
Geodesy	279	221	14	29	8	170	0	0	0	3	0	55	0	0	0	0
Geology	1,651	309	301	5	2	1	0	180	0	1,033	2	2	5	13	17	28
Geophysics	336	129	13	94	17	5	0	0	0	172	0	31	0	0	0	3
Hydrology	1,427	29	29	0	0	0	0	132	0	1,094	2	147	1	12	0	2
Metallurgy	637	389	136	197	56	1	0	0	0	127	58	28	3	1	3	17
Meteorology	2,169	236	67	58	107	4	0	29	0	17	6	1,857	10	4	3	5
Physics	5,607	4,223	1,206	2,314	683	20	39	47	82	127	315	603	0	28	0	74
Other physical sciences	1,267	696	69	583	3	21	6	24	86	15	8	188	11	36	11	175
Health physics	424	115	33	72	3	7	6	3	84	6	5	4	2	19	11	169
Oceanography	751	521	25	483	0	13	0	0	1	9	3	181	9	17	0	6
Textile technology	92	60	31	28	0	1	0	21	0	0	0	3	0	0	0	0
Mathematics and statistics	9,510	5,160	1,752	2,193	898	317	56	592	717	111	817	1,083	179	110	65	44
Actuary	95	20	0	0	19	1	4	0	35	0	0	0	0	0	0	1
Mathematics	4,181	2,884	810	1,348	548	162	10	18	45	14	606	189	66	12	39	2
Mathematical statistician	822	323	138	124	43	18	4	80	170	7	0	109	16	18	14	8
Operations research	2,233	1,774	726	662	265	121	4	14	53	3	8	91	73	66	0	31
Statistics	2,179	179	78	61	25	15	34	480	414	18	3	674	22	14	12	2
Life sciences	28,098	1,450	1,158	189	70	33	407	18,096	1,897	4,716	72	548	25	586	122	28
General biological sciences	3,006	370	286	53	15	16	106	396	549	908	14	16	7	342	39	22
Microbiology	1,512	244	170	56	10	8	235	200	672	10	18	15	0	114	0	0
Agricultural sciences	10,107	92	75	7	10	0	5	9,627	25	206	3	2	1	17	51	1
Agriculture extension service	99	0	0	0	0	0	0	88	0	0	0	0	0	0	0	1
Agricultural management	3,289	0	0	0	0	0	0	3,218	0	0	0	0	0	0	51	0
Agronomy	327	62	52	0	10	0	0	228	0	7	3	0	0	4	0	0
Horticulture	104	10	10	0	0	0	5	59	1	18	0	0	0	1	0	0
Husbandry	114	7	7	0	0	0	0	66	24	1	0	2	0	2	0	0
Soil conservation	4,473	7	0	7	0	0	0	4,392	0	74	0	0	0	0	0	0
Soil science	1,701	6	6	0	0	0	0	1,576	0	105	0	0	1	10	0	1

AND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIES, AND AGENCY: OCTOBER 1973

Department of Defense																All other agencies
Army	Navy	Air Force	Other	VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC	State	Labor	
5,896	30,116	11,486	4,356	3,199	24,490	6,028	12,911	11,972	7,168	5,391	3,486	2,374	2,119	1,510	1,325	6,166
7,473	7,299	2,657	3,200	2,572	21,443	5,352	8,814	2,322	6,423	541	1,894	383	686	1,272	1,161	3,220
3,902	4,662	1,462	716	883	1,579	1,820	3,446	1,416	3,985	170	1,107	121	608	82	7	709
6	78	17	0	0	0	0	0	474	3	0	0	0	0	0	0	18
1,107	776	389	124	634	1,127	1,610	594	82	344	30	567	80	104	1	7	390
940	428	221	370	4	40	43	283	469	727	70	426	4	200	58	0	182
14	29	8	170	0	0	0	3	0	55	0	0	0	0	0	0	0
301	5	2	1	0	180	0	1,033	2	2	5	13	17	28	1	0	61
13	94	17	5	0	0	0	172	0	31	0	0	0	3	0	0	0
29	0	0	0	0	122	0	1,034	2	147	1	12	0	2	1	0	7
196	187	55	1	0	0	0	127	58	28	3	1	6	17	0	0	8
67	86	107	4	0	29	0	17	8	1,857	10	4	3	5	0	0	2
1,206	2,314	683	20	39	47	82	127	315	609	40	28	0	74	0	0	29
89	583	3	21	6	24	86	15	6	188	11	36	11	175	0	0	12
33	72	3	7	6	3	84	6	5	4	2	19	11	169	0	0	0
25	483	0	13	0	0	1	9	3	181	9	17	0	6	0	0	4
31	28	0	1	0	21	0	0	0	3	0	0	0	0	0	0	8
1,762	2,193	898	317	56	592	717	111	817	1,083	179	110	65	44	13	137	446
7	0	19	1	4	0	35	0	0	0	0	0	0	1	0	6	29
810	1,346	546	162	10	18	45	83	806	189	68	12	39	2	0	0	45
138	124	43	18	4	80	170	7	0	109	16	18	14	8	0	27	46
726	662	265	121	4	14	53	3	8	91	73	66	0	31	1	2	113
78	61	25	15	34	480	414	18	3	674	22	14	12	2	12	102	213
1,158	189	70	33	407	18,096	1,597	4,716	72	548	26	586	122	28	204	0	247
286	53	15	16	106	396	549	908	14	16	7	342	39	22	132	0	115
170	56	10	8	235	200	672	10	18	15	0	114	0	0	1	0	3
75	7	10	0	5	9,627	25	205	3	2	1	17	51	1	64	0	14
0	0	0	0	0	88	0	0	0	0	0	0	0	0	10	0	1
0	0	0	0	0	3,218	0	0	0	0	0	0	51	0	20	0	0
52	0	10	0	0	228	0	7	3	0	0	4	0	0	20	0	3
10	0	0	0	5	59	1	18	0	0	0	1	0	0	1	0	9
7	0	0	0	0	66	24	1	0	2	0	0	2	0	11	0	1
0	7	0	0	0	4,392	0	74	0	0	0	0	0	0	0	0	0
6	0	0	0	0	1,576	0	106	0	0	1	10	0	1	2	0	8

TABLE A.—SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIE AGENCY: OCTOBER 1973—Con.

Occupational group and series	All agencies	Department of Defense					VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC
		Total	Army	Navy	Air Force	Other										
Animal sciences	1,201	167	89	51	21	6	44	674	133	27	37	10	15	41	0	2
Entomology	734	47	22	21	4	0	0	607	35	1	0	0	0	30	0	0
Physiology	328	99	49	27	17	6	44	29	82	10	37	4	15	6	0	2
Zoology	139	21	18	3	0	0	0	38	16	16	0	6	0	5	0	0
Plant sciences	1,541	13	13	0	0	0	0	1,446	5	21	0	1	0	24	6	0
Botany	121	8	8	0	0	0	0	64	1	16	0	1	0	4	6	0
Plant pathology	312	1	1	0	0	0	0	297	2	2	0	0	0	9	0	0
Plant physiology	225	4	4	0	0	0	0	202	2	3	0	0	0	11	0	0
Plant quarantine and pest control	884	0	0	0	0	0	0	883	0	0	0	0	0	0	0	0
Forestry	5,578	114	85	18	9	2	0	4,915	0	503	0	0	0	2	24	0
Forestry	5,446	112	85	18	9	0	0	4,786	0	533	0	0	0	1	24	0
Forestry products technology	132	2	0	0	0	2	0	129	0	0	0	0	0	1	0	0
Fishery and wildlife sciences	2,043	40	37	1	2	0	0	147	0	1,331	0	488	0	20	2	1
Fishery biology	991	16	16	0	0	0	0	28	0	494	0	426	0	19	0	1
General fish and wildlife administration	126	11	10	1	0	0	0	1	0	55	0	57	0	0	2	0
Wildlife biology	615	12	10	0	2	0	0	118	0	472	0	5	0	1	0	0
Wildlife refuge management	311	1	1	0	0	0	0	0	0	310	0	0	0	0	0	0
Other biological sciences	3,110	410	403	3	3	1	17	701	213	1,711	0	16	2	28	0	2
Food technology	157	38	37	1	0	0	0	82	21	0	0	15	0	0	0	0
Genetics	186	2	0	0	1	1	3	151	22	2	0	1	0	0	0	2
Park management	1,867	347	347	0	0	0	0	0	0	1,520	0	0	0	0	0	0
Pharmacology	247	22	18	2	2	0	14	6	170	0	0	0	2	26	0	0
Range conservation	653	1	1	0	0	0	0	462	0	189	0	0	0	0	0	0
Social sciences	7,019	348	293	12	13	30	202	1,056	920	198	2	587	97	63	41	15
Anthropological sciences	103	12	8	0	4	0	1	5	5	40	0	0	3	0	0	0
Archeology	48	1	1	0	0	0	0	5	0	40	0	0	0	0	0	0
General anthropology	55	11	7	0	4	0	1	0	5	0	0	0	3	0	0	0
Economics	4,638	269	235	3	8	23	3	885	79	150	2	504	88	62	39	14
Foreign agricultural affairs	128	0	0	0	0	0	0	128	0	0	0	0	0	0	0	0
Manpower research analysis	78	0	0	0	0	0	0	0	2	0	0	1	0	0	0	1
Social science	2,003	58	41	9	1	7	196	28	801	4	0	74	5	1	2	0
Sociology	69	9	9	0	0	0	2	10	33	4	0	8	1	0	0	0

AND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIES, AND AGENCY: OCTOBER 1973—Con.

Department of Defense															
Army	Navy	Air Force	Other	VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC	State	Labor	All other agencies
88	51	21	6	44	674	133	27	37	10	15	41	0	2	1	0	50
22	21	4	0	0	607	35	1	0	0	0	30	0	0	1	0	13
49	27	17	6	44	29	82	10	37	4	15	6	0	2	0	0	0
18	3	0	0	0	38	16	16	0	6	0	5	0	0	0	0	37
13	0	0	0	0	1,446	5	21	0	1	0	24	6	0	1	0	24
8	0	0	0	0	64	1	16	0	1	0	4	6	0	0	0	20
1	0	0	0	0	297	2	2	0	0	0	9	0	0	0	0	1
4	0	0	0	0	202	2	3	0	0	0	11	0	0	0	0	3
0	0	0	0	0	883	0	0	0	0	0	0	0	0	1	0	0
85	18	9	2	0	4,915	0	503	0	0	0	2	24	0	0	0	20
85	18	9	0	0	4,786	0	503	0	0	0	1	24	0	0	0	20
0	0	0	2	0	129	0	0	0	0	0	1	0	0	0	0	0
37	1	2	0	0	147	0	1,331	0	488	0	20	2	1	0	0	14
16	0	0	0	0	28	0	494	0	426	0	19	0	1	0	0	7
10	1	0	0	0	1	0	55	0	57	0	0	2	0	0	0	0
10	0	2	0	0	118	0	472	0	5	0	1	0	0	0	0	7
1	0	0	0	0	2	0	310	0	0	0	0	0	0	0	0	0
403	3	3	1	17	701	213	1,711	0	16	2	22	0	2	5	0	7
37	1	0	0	0	82	21	0	0	15	0	0	0	0	1	0	0
0	0	1	1	3	151	22	2	0	1	0	0	0	2	2	0	1
347	0	0	0	0	0	0	1,520	0	0	0	0	0	0	0	0	0
18	2	2	0	14	6	170	0	0	0	2	26	0	0	1	0	6
1	0	0	0	0	462	0	179	0	0	0	0	0	0	1	0	0
293	12	13	30	202	1,056	920	198	2	587	97	63	41	15	972	1,008	1,510
8	0	4	0	1	5	5	40	0	0	3	0	0	0	18	0	19
1	0	0	0	0	5	0	40	0	0	0	0	0	0	0	0	2
7	0	4	0	1	0	5	0	0	0	3	0	0	0	18	0	17
236	3	8	23	3	885	79	150	2	504	88	62	39	14	896	792	855
0	0	0	0	0	128	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	2	0	0	1	0	0	0	1	0	74	0
41	9	1	7	196	28	801	4	0	74	5	1	2	0	58	142	634
9	0	0	0	2	10	33	4	0	8	1	0	0	0	0	0	2

TABLE A.—SCIENTISTS AND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIES, AGENCY: OCTOBER 1973—Con.

Occupational group and series	All agencies	Department of Defense					VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC	St
		Total	Army	Navy	Air Force	Other											
Geography and cartography	2,889	2,213	85	18	16	2,094	0	117	2	331	1	213	5	1	0	0	
Geography	132	78	51	1	0	26	0	8	2	16	0	13	2	1	0	0	
Cartography	2,569	2,129	30	17	15	2,067	0	63	0	169	1	200	3	0	0	0	
Land surveying	198	6	4	0	1	1	0	46	0	146	0	0	0	0	0	0	
Psychology	2,492	760	261	315	176	8	1,224	1	292	6	14	26	49	3	0	0	
Community planning	319	36	22	10	2	2	0	2	4	7	0	1	16	14	34	0	
Engineering	84,277	52,222	19,422	22,816	8,828	1,156	817	3,047	676	4,097	9,860	745	4,850	1,614	1,981	1,424	2
General engineering	14,593	8,018	3,072	4,173	1,461	312	371	66	132	424	2,519	141	674	138	77	228	
Industrial engineering	2,396	1,928	689	440	610	189	6	22	24	7	7	4	24	9	0	32	
Materials engineering	848	551	146	206	189	10	1	6	1	8	221	13	2	5	32	2	
Chemical and related	1,586	787	435	284	61	7	0	73	25	175	17	23	11	300	87	75	
Ceramic engineering	57	29	17	9	3	0	0	0	0	8	17	2	0	0	0	0	
Chemical engineering	1,529	758	418	275	58	7	0	73	25	167	0	21	11	300	87	75	
Civil and related	16,300	8,058	6,411	936	681	30	72	2,092	267	1,683	17	93	2,155	905	443	39	
Civil engineering	15,064	7,860	6,296	888	647	29	70	2,017	125	1,670	17	92	2,151	86	443	35	
Sanitary engineering	1,236	196	115	48	34	1	2	25	142	13	0	1	1	819	0	4	
Electrical and electronic	22,977	16,445	3,993	8,957	3,044	451	59	196	92	835	2,029	328	1,398	31	787	54	
Electrical engineering	4,368	2,041	700	1,032	295	14	34	98	27	683	320	18	118	11	787	22	
Electronic engineering	18,608	14,404	3,293	7,925	2,749	437	25	98	65	152	1,709	308	1,280	20	0	32	
Mechanical and related	22,247	14,458	4,252	7,446	2,619	141	47	83	68	182	4,824	122	536	212	467	932	
Aerospace engineering	9,048	3,986	868	1,424	1,650	44	0	1	0	0	4,683	5	370	1	0	0	
Mechanical engineering	10,356	8,712	3,345	4,307	967	93	47	80	68	179	132	94	148	202	381	20	
Naval architecture	1,093	1,054	15	1,039	0	0	0	0	0	0	0	10	20	0	0	0	
Nuclear engineering	1,751	706	24	676	2	4	0	2	0	3	9	4	0	9	106	912	
Other engineering	3,330	977	424	374	163	16	61	519	67	783	16	23	50	11	78	62	
Agricultural engineering	494	3	0	3	0	0	0	438	0	39	0	0	0	7	0	0	
Architecture	1,316	571	236	226	105	4	54	58	60	90	2	13	27	1	35	0	
Fire prevention engineering	93	53	10	28	15	0	0	0	0	0	3	5	0	0	6	20	
Mining engineering	545	1	1	0	0	0	0	20	0	462	0	0	0	3	9	20	
Petroleum engineering	288	15	4	11	0	0	0	1	0	179	0	0	10	0	0	0	
Safety engineering	532	256	168	36	40	12	7	2	7	13	10	4	11	0	28	22	
Welding engineering	82	78	5	70	3	0	0	0	0	0	1	1	2	0	0	0	

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

ND ENGINEERS IN THE FEDERAL GOVERNMENT, BY OCCUPATIONAL GROUP, DETAILED SERIES, AND AGENCY: OCTOBER 1973—Con.

Department of Defense																
ny	Navy	Air Force	Other	VA	USDA	HEW	Interior	NASA	Commerce	DOT	EPA	TVA	AEC	State	Labor	All other agencies
85	18	16	2,094	0	117	2	331	1	213	5	1	0	0	11	0	5
51	1	0	26	0	8	2	15	0	13	2	1	0	0	10	0	2
30	17	15	2,057	0	63	0	169	1	200	3	0	0	0	1	0	3
4	0	1	1	0	46	0	146	0	0	0	0	0	0	0	0	0
31	315	176	8	1,224	1	252	6	14	26	40	3	0	0	1	9	107
22	10	2	2	0	2	4	7	0	1	16	14	34	0	9	0	196
22	22,816	8,828	1,156	617	3,047	676	4,097	9,650	745	4,850	1,614	1,991	1,424	238	184	2,946
72	4,173	1,461	312	371	66	132	424	2,519	141	674	138	77	228	86	1	718
80	440	610	189	6	22	24	7	7	4	24	9	0	32	1	1	331
46	206	189	10	1	6	1	8	221	13	2	5	32	2	0	0	6
36	284	61	7	0	73	25	175	17	23	11	300	87	76	0	0	13
17	9	3	0	0	0	0	8	17	2	0	0	0	0	0	0	1
18	275	58	7	0	73	25	167	0	21	11	300	87	76	0	0	12
11	936	681	30	72	2,082	267	1,683	17	93	2,155	906	443	39	76	1	410
98	888	647	29	70	2,057	125	1,670	17	92	2,154	86	443	35	70	1	384
15	48	34	1	2	25	142	13	0	1	1	819	0	4	5	0	26
93	8,957	3,044	461	59	196	92	836	2,029	326	1,398	31	787	54	82	1	682
00	1,032	295	14	34	98	27	683	320	18	118	11	787	22	11	0	198
93	7,925	2,749	437	25	98	65	152	1,709	308	1,280	20	0	32	51	0	484
52	7,446	2,619	141	47	83	68	182	4,824	122	536	212	437	932	3	1	292
68	1,424	1,650	44	0	1	0	0	4,683	5	370	1	0	0	0	0	2
46	4,307	967	93	47	70	68	179	132	94	146	202	381	20	3	1	290
15	1,039	0	0	0	0	0	0	0	10	20	0	0	0	0	0	0
24	676	2	4	0	2	0	3	9	4	0	9	106	912	0	0	0
24	374	163	16	61	519	67	783	16	23	50	11	78	62	11	159	513
0	3	0	0	0	438	0	39	0	0	0	7	0	0	5	0	2
36	226	105	4	54	58	60	90	2	13	27	1	35	0	5	1	399
10	28	15	0	0	0	0	0	3	5	0	0	6	20	0	2	4
1	0	0	0	0	20	0	462	0	0	0	3	9	20	1	0	29
4	11	0	0	0	1	0	178	0	0	10	0	0	0	0	0	63
68	36	40	12	7	2	7	13	10	4	11	0	28	22	0	156	16
5	70	3	0	0	0	0	0	1	1	2	0	0	0	0	0	0

e U.S. Civil Service Commission.

TABLE B.—FEDERAL SCIENTISTS AND ENGINEERS BY HIGHEST DEGREE HELD AND SELECTED AGENCY: JANUARY 1974

Degree levels	All agencies	DOD	USDA	HEW	Interior	NASA	Commerce	DOT	AEC	EPA	All other agencies
						Scientists and engineers					
Total	131,562	54,172	24,063	6,123	10,689	11,801	6,928	4,712	2,074	1,607	9,405
Degreed scientists and engineers	122,236	49,985	23,220	5,592	10,097	11,116	6,061	3,939	1,986	1,591	8,171
Ph.D.	11,934	3,046	2,657	881	811	909	1,011	144	269	219	1,888
Master's	26,076	10,571	3,822	1,532	1,836	2,719	1,517	786	631	721	1,942
Bachelor's	82,402	35,892	16,589	2,378	7,361	7,922	3,498	2,976	1,078	637	4,072
Professional degree	1,826	457	152	801	89	66	33	35	8	14	169
Non-degreed[1]	9,324	4,217	863	531	582	195	895	773	88	16	1,234
						Scientists					
Total	85,176	14,570	21,108	5,443	6,981	2,309	6,192	440	675	864	6,594
Degreed scientists	80,751	13,468	20,377	4,970	6,590	2,293	5,394	419	654	854	5,732
Ph.D.	10,329	2,319	2,556	856	755	529	946	92	157	172	1,948
Master's	14,407	3,914	3,441	1,324	1,488	586	1,326	154	194	363	1,607
Bachelor's	34,806	7,135	14,251	2,022	4,300	1,158	3,093	160	302	312	2,084
Professional degree	1,209	100	130	768	47	10	29	4	1	7	113
Non-degreed[1]	4,425	1,102	731	473	391	16	798	21	21	10	862
						Engineers					
Total	66,386	39,602	2,975	680	3,678	9,492	734	4,272	1,399	743	2,811
Degreed engineers	61,487	36,497	2,843	622	3,507	9,323	667	3,520	1,332	737	2,439
Ph.D.	1,605	726	102	25	56	380	65	52	112	47	40
Master's	11,669	6,657	381	208	348	2,123	191	631	437	358	335
Bachelor's	47,596	28,757	2,338	356	3,061	6,764	405	2,808	776	325	2,008
Professional degree	617	357	22	33	42	56	6	31	7	7	56
Non-degreed[1]	4,899	3,105	132	56	171	169	67	752	67	6	372

[1]Includes 4 years college but no degree, 1-3 years college, and associate degree holders.
SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

TABLE C.—OCCUPATIONS OF DEGREED FEDERAL SCIENTISTS, BY ACADEMIC DISCIPLINE: JANUARY 1974

Occupational group	Academic disciplines													
	Total scientists	Physical scientists						Life scientists				Social scientists		
		Total	Physical scientists	Chemists	Physicists	Other physical scientists	Mathematicians and statisticians	Total	Agricultural scientists	Foresters	Other life scientists	Total	Economists	Other social scientists
Total scientists	60,751	14,684	390	5,397	4,058	4,839	4,637	24,425	9,859	5,964	8,602	5,873	3,691	2,182
Physical sciences	20,828	13,898	346	5,280	3,720	4,572	632	1,917	175	141	1,601	174	18	156
Mathematics and statistics	7,471	470	28	54	324	64	3,916	262	115	15	132	1,010	696	314
Life sciences	24,513	201	8	75	5	113	16	22,047	9,475	5,767	6,805	968	709	257
Social sciences	5,147	20	4	7	3	6	45	131	84	12	35	3,483	2,258	1,225
Geography and cartography	557	94	4	1	5	84	23	53	10	29	14	221	9	212
Psychology	2,235	1	0	0	1	0	5	15	0	0	15	19	1	18

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

TABLE D.—OCCUPATIONS OF DEGREED FEDERAL ENGINEERS, BY ACADEMIC DISCIPLINE: JANUARY 1974

Occupational group	Academic disciplines												
	Total engineers	Engineering disciplines									Physical scientists	Mathematicians and statisticians	Life scientists
		Total	Industrial	Materials	Chemical and related	Civil and related	Electrical and electronic	Mechanical and related	Mining and petroleum	Other			
Total engineers	61,487	51,707	2,140	380	1,805	10,817	15,290	15,771	1,170	4,364	3,336	1,211	261
General engineering	10,814	8,729	638	69	310	1,539	1,900	3,232	161	880	694	271	39
Industrial engineering	1,529	1,308	815	11	44	44	59	229	23	83	15	13	3
Materials engineering	663	394	9	112	89	20	10	127	3	24	199	13	9
Chemical and related engineering	930	766	9	28	669	7	6	26	4	17	138	2	5
Civil and related engineering	12,169	11,120	65	14	97	8,526	134	428	282	1,574	129	59	130
Electrical and electronic engineering	15,879	13,194	166	7	79	115	11,865	371	96	495	1,203	339	28
Mechanical and related engineering	17,118	14,715	379	87	480	476	2,283	11,248	76	686	863	505	31
Mining and petroleum engineering	695	520	1	5	12	19	7	24	512	10	68	1	1
Other engineering	1,660	891	58	27	25	71	26	86	13	585	27	8	15

SOURCE: National Science Foundation, based on data of the U.S. Civil Service Commission.

U.S. GOVERNMENT PRINTING OFFICE : 1976 O - 204-816

LE C.—OCCUPATIONS OF DEGREED FEDERAL SCIENTISTS, BY ACADEMIC DISCIPLINE: JANUARY 1974

Total scientists	Academic disciplines															
	Physical scientists						Life scientists				Social scientists					
	Total	Physical scientists	Chemists	Physicists	Other physical scientists	Mathematicians and statisticians	Total	Agricultural scientists	Foresters	Other life scientists	Total	Economists	Other social scientists	Psychologists	Engineers	Non-scientists/ non-engineers
60,751	14,684	390	5,397	4,058	4,839	4,637	24,425	9,859	5,964	8,602	5,873	3,691	2,182	2,337	4,060	4,735
20,828	13,898	346	5,260	3,720	4,572	632	1,917	175	141	1,601	174	18	156	48	3,023	1,136
7,471	470	28	54	324	64	3,916	262	115	15	132	1,010	696	314	115	611	1,087
24,513	201	8	75	5	113	16	22,047	9,475	5,767	6,805	998	741	257	22	337	924
5,147	20	4	7	3	6	45	131	84	12	35	3,483	2,258	1,225	147	24	1,297
557	94	4	1	5	84	21	53	10	29	14	221	9	212	2	62	102
2,235	1	0	0	1	0	5	15	0	0	15	19	1	18	2,003	3	189

ased on data of the U.S. Civil Service Commission

BLE D.—OCCUPATIONS OF DEGREED FEDERAL ENGINEERS, BY ACADEMIC DISCIPLINE: JANUARY 1974

	Academic disciplines															
	Total engineers	Engineering disciplines									Physical scientists	Mathematicians and statisticians	Life scientists	Social scientists	Psychologists	Non-scientists/ non-engineers
		Total	Industrial	Materials	Chemical and related	Civil and related	Electrical and electronic	Mechanical and related	Mining and petroleum	Other						
.....	61,487	51,707	2,140	360	1,805	10,817	16,290	15,771	1,170	4,364	3,336	1,211	281	202	25	4,745
.....	10,814	8,729	638	69	310	1,539	1,900	3,232	161	880	694	271	39	73	10	998
.....	1,529	1,308	815	11	44	44	59	229	23	83	15	13	3	10	3	177
.....	863	394	9	112	89	20	10	127	3	24	199	13	9	0	0	48
g.....	960	766	9	28	669	7	6	26	4	17	138	2	5	1	0	48
.....	12,169	11,120	65	14	97	8,526	134	428	282	1,574	129	50	130	32	0	699
ring ...	15,879	13,194	166	7	79	115	11,966	371	96	495	1,203	339	28	40	3	1,072
ing	17,118	14,715	379	87	480	476	1,283	11,248	76	686	863	505	31	39	8	959
ng.....	695	580	1	5	12	19	7	24	512	10	68	1	1	3	0	32
.....	1,680	891	58	27	25	71	26	86	13	585	27	8	15	4	3	712

based on data of the U.S. Civil Service Commission.